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COMMITTEE ON THE PEACEFUL
USES OF OUTER SPACE

REPORT ON THE UNITED NATIONS WORKSHOP ON ENHANCING SOCIAL, ECONOMIC AND ENVIRONMENTAL SECURITY THROUGH SPACE TECHNOLOGY, HOSTED BY THE GOVERNMENT OF AUSTRIA

(Graz, Austria, 12-15 September 1994)

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INTRODUCTION

A. Background and objectives

1. The United Nations Office for Outer Space Affairs (OOSA) has organized several regional and international conferences and workshops on various aspects of space science and technology. Participants in these activities have developed a number of recommendations concerning the establishment of space-related infrastructure and the potential of accelerating, by the proper use of space technology, the economic and social development of a country. In this context, the United Nations and the Government of Austria agreed to jointly organize a Workshop entitled "Enhancing social, economic and environmental security through space technology".

2. This Workshop was included in the 1994 activities of the Space Applications Programme of the United Nations Office for Outer Space Affairs and was held from 12 to 15 September 1994 in Graz, Austria. The Workshop was hosted by the Austrian Federal Ministry for Foreign Affairs, co-sponsored by the State of Styria, the City of Graz and the European Space Agency (ESA).

3. The objective of the Workshop was to show that space technology can be a powerful tool for accelerating national development and that it provides a way of overcoming obsolete technologies and an alternative to percolation and trickle-down models of national development. The application of space technology can effectively deal with problems of illiteracy, isolation and lack of information afflicting the development process. Depending upon each country's unique social, economic, cultural and resource context, and taking account of other alternative technologies, space can play an important role in specific areas of development. Participants in this Workshop were expected to apply the experience gained therein to projects, and to report to the appropriate authorities in their own countries.

4. The participants expressed their appreciation to the United Nations, the Government of Austria, the State of Styria, the City of Graz and to ESA, for sponsoring the Workshop and for the technical quality of the programme. The present report has been prepared for the Committee on the Peaceful Uses of Outer Space and its Scientific and Technical Subcommittee.

B. Organization and programme of the Workshop

5. The United Nations invited developing countries to nominate candidates to participate in the Workshop. The participants were senior technical personnel in decision-making positions who were actively engaged in projects dealing with satellite communications or Earth observations.

6. The following Member States and international organizations were represented at the Workshop: Argentina, Austria, Bangladesh, Bhutan, Brazil, Cameroon, Cape Verde, Cambodia, China, Costa Rica, France, Germany, India, Indonesia, Iran (Islamic Republic of), Italy, Mongolia, Netherlands, Pakistan, Poland, Republic of Korea, Russian Federation, Senegal, Sri Lanka, Syrian Arab Republic, Tunisia, Uganda, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, ESA, International Maritime Satellite Organization (INMARSAT) and the United Nations Office for Outer Space Affairs.

7. The participants were jointly selected by the sponsors and the funds allocated were used to cover the cost of international air travel, per diem and hotel expenses for the period of the meeting. The financial support provided by the sponsors enabled the participation of 42 persons in the Workshop.

8. The Workshop was formally opened by representatives of the Austrian Ministry for Science and Research, the State of Styria and the Mayor of the City of Graz. An opening statement was also made by the Director of the United Nations Office for Outer Space Affairs, N. Jasentuliyana. Keynote and theme

addresses were delivered by the Director General of the German Space Agency, B. Mennicken, and the former Chairman of the Indian Space Research Organization, U. R. Rao. The opening session was chaired by P. Hohenfellner, Chairman of the United Nations Committee on the Peaceful Uses of Outer Space. The session on space education was chaired by P. Jankowitsch, former Chairman of the Committee. R. Gibson developed the observations and recommendations to the Workshop.

9. The United Nations developed the programme (see annex to the present report) in collaboration with the Austrian Federal Ministry for Foreign Affairs and the other co-sponsors. The Workshop consisted of an integrated series of lectures, case-study presentations, discussions and exchange of views among participants, and was conducted through a series of plenary and working group sessions.

I. PRESENTATIONS TO THE WORKSHOP

A. General

10. Several papers were presented to the Workshop. Presentations focused on the applications of space technology for improving life on Earth while protecting the environment. The theme of the meeting built upon Agenda 21,[1] adopted by the United Nations Conference on the Environment and Development (UNCED), held in Rio de Janeiro in June 1992, and its recommendations for sustainable development.

11. Through technical presentations and discussions, participants addressed the issues of how to best safeguard the environment and to ensure the efficient management and sustainable development of natural resources. Applications for the exploitation of natural resources as well as for the prevention and amelioration of environmental damage were also presented.

12. Several of the presentations recommended that policy issues related to the exploitation of space technologies for sustainable development should be given a high priority in national developmental programmes.

13. The need for modern equipment and facilities was stressed. Papers also discussed ways and means of how developing countries could, through the examination and discussion of substantive projects, best utilize the experience of other countries to assist in their own development process.

14. It was stated that the growing range of space applications has brought benefits to many countries. While many developing countries use space technology, its considerable potential has not yet been fully exploited. For this reason, the international space community, and in particular countries with more advanced technology, should intensify their efforts to promote the wider exploitation of space technology by developing countries.

15. The presentations concentrated on the aspect of cooperation in using space communication and remote sensing technologies for economic and social development and environmental protection. The intersections of these new technologies with political, social, economic and environmental issues were stressed and the unique needs of the developing world and the issues for implementing them were also addressed.

B. Telecommunications

16. In the field of telecommunications reference was made to the recent advances in direct-broadcast and mobile communication services, which contain a number of technologies to increase power, signal-to-noise ratios and the rates of operation. The size and cost of ground stations has, along with major increases in the potential number of users that can be serviced and the quality and quantity of services that can be delivered,

also dropped dramatically. These new advancements are particularly important for the developing world because they either enable services that cannot be delivered by ground-based cables or microwave links, or obviate the need for costly installations of ground-based facilities.

17. It was also noted that direct-broadcast television and radio services have been available on a limited basis for several years, but will during the next few years expand significantly, with several new geostationary orbit systems being launched in both the Eastern and Western hemispheres. These satellite systems will be able to transmit to ground-based antennas as small as 45 cm in diameter, and will enable the receipt of both foreign and domestic radio and television programmes in remote and rural areas. These programmes can include information on agriculture, weather, education and training and will be provided at costs sufficiently low for relatively widespread use in developing countries.

18. Several papers examined the forthcoming generation of satellites which will utilize high-powered spot-beam geostationary orbit spacecraft and low-earth orbit multiple satellite constellations to provide full communication access by using much smaller, less expensive ground terminals as well as hand-held terminals. This new technology will be a critical tool for the developing world to overcome inadequate communication links hindering sustained development.

19. It was noted that several companies and entrepreneurs have entered the area of satellite communications, which continues to revolutionize business around the world. Similarly, many countries have established earth stations to receive satellite data and some have developed indigenous capabilities to design, build and operate their own communication systems.

20. The vast territorial limits of many countries and the inaccessibility of some areas in these countries have provided the impetus to use space-based communications to improve cooperation and information dissemination to remote and rural areas and to facilitate relief efforts in times of natural disasters. Satellite communications have been used extensively for these purposes in China, India and Indonesia.

C. Remote sensing

21. Presentations on remote sensing focused on the opportunities for using satellite data for economic growth and environmental monitoring. The development of high-resolution spacecraft was discussed as well as the currently available low-cost, high-speed and high-quality computer processing of electronic image data and the integration of remote sensing services with satellite communications and position location capabilities.

22. It was stated that the developing countries will be able to utilize new developments in remote sensing systems to gain access to significantly greater quantities of valuable data. Presentations highlighted applications in areas such as forestry, geology and mineral resources, cartography and other fields. It was emphasized that compared with conventional ground surveys, satellite observations provide less detail but much greater economy, especially when repetitive monitoring is required.

23. It was noted that large-scale phenomena or features that are not visible to a ground observer can often be identified on satellite images. Phenomena and resources that transcend boundaries can easily be observed by using remote sensing with much less logistical or administrative difficulty than is the case with ground surveys.

24. It was also stated that dynamic and subtle changes in resources and features can be measured from satellite images, which are regularly acquired by the same sensors under the same conditions. Remote sensing can provide up-to-date and accurate information, which is essential for appropriate policy formulation and effective decision-making in the developing countries.

25. With growing concern about the rapid degradation of the environment and national and regional resources, many countries have adopted remote sensing technology to suit local conditions and requirements. Remote sensing has proven to be a vital tool but there has been a great deal of duplicated effort in the developing countries. A concern that needs attention, therefore, is the establishment of effective regional mechanisms to ensure the harmonization of technical planning, operation and standardization of equipment.

26. It should be noted that the availability of a greater volume of spatial data and information from Earth observation systems underscores the need for a tool to analyse and manipulate such data for decision-making. It was noted that Geographical Information Systems (GIS) constitute such a tool and that these systems have developed into an important and indispensable instrument.

D. Space education

27. There is a need for continued long-term education in the developing world. The relevance of space science and technology to the social and economic development of a country was highlighted and it was stated that the developing countries will require assistance in undertaking space science and technology education programmes. These include the use of communication satellites for broadcasting educational programmes to rural and remote areas, the use of Earth observation satellites to conduct national resource surveys and to monitor resource exploration, as well as the use of meteorological satellites to minimize the economic and environmental impact of natural disasters such as droughts, cyclones and floods.

28. In the field of remote sensing it was noted that several countries had started acquiring systems and that many developing countries were participating in the applications of remote sensing. Moreover, some developing countries had plans to develop their own integrated indigenous programmes and a few developing countries had already developed their own systems.

29. It was stated that the need for the development of remote sensing skills and knowledge at the local level derived from their importance to economic and social development. Since the beginning of the space age, remote sensing technology and its application have steadily become more important to development.

30. Special efforts should therefore be made to initiate technical assistance programmes in order to stimulate more widespread training and education of scientists and educators in the relevant aspects of space science at all levels of society. National and international organizations and aid agencies could play a vital role in implementing this form of indigenous capability development.

31. Experiences gained by the United Nations and the International Institute for Aerospace Survey and Earth Sciences of the Netherlands in the process leading to the establishment of centres of space science and technology were presented. It was stated that an indispensable aspect of any educational programme was the availability of teachers, and that these teachers were presently not available in most developing countries.

II. OBSERVATIONS AND RECOMMENDATIONS

32. The Workshop was intended to build on Agenda 21 of UNCED. Presentations were made by leading experts from many parts of the world and ample time was available for discussion between participants and the many knowledgeable specialists from developing countries. As the title of the Workshop indicates, discussions focused on the problems connected with the application of space technology for enhancing social, economic and environmental security in developing countries. The word "security" in this context is interpreted as ensuring the sustainability of the development.

33. The Workshop programme was divided into sessions on Earth Observation, Satellite Telecommunications and Space Education. There were no parallel sessions. It was recognized from the outset, however, that there are extensive linkages between these three elements, and for this reason the emphasis has been placed on developing common recommendations relevant to each area.

34. It should be noted, moreover, that many of the points raised apply equally to developed and developing countries.

A. Common points

35. Participants agreed on the following common points:

(a) Space technology can make important contributions to improving social and economic conditions, and its potential should be recognized and better publicized;

(b) It is for developing countries to define their own needs and the services they require, not in space terms, but rather as a function of their short-term and long-term priorities and plans. This is not a "space" task, and involves inputs from a wide range of non-space disciplines;

(c) Developing countries need to be advised to seek impartial advice, to be considered against the background of their goals, before entering into new commitments involving space technology. Even well-meant gifts need to be carefully evaluated to ensure that they are compatible with the most optimal way ahead;

(d) Each developing country should have access to national or regional space competence, to help define goals and needs in order to obtain an appropriate mix of space and non-space technologies;

(e) This "space competence" does not necessarily entail having one's own satellite – it simply means being able to understand the advantages and the limitations of space technology in the search to solve practical problems;

(f) Developing countries are advised not to overlook the value of having at least a minimum level of scientific competence to underpin the use of space technologies;

(g) The national "space competence", however modest, must not be isolated. It needs constant contact with governmental user departments and ministries. Above all, success depends on a clear expression of political will to apply space techniques in solving national problems;

(h) There will be constant temptations to use the latest technologies and care must be taken to get the right mix between new and existing technologies. For Earth observation purposes, use can certainly be made of simple technology, whereas in satellite telecommunications the use of the latest technologies may be the best way to cut operating and maintenance costs and thereby reduce costs to the end user;

(i) Only in the field of meteorology is there an international organization (and regional organizations) which applies space technology. For other satellite applications, systems are provided by space agencies or by commercial entities. No international organization is geared specifically towards the needs of developing countries in this area. The lack of such an organization is a real impediment to the developing countries adequately benefiting from the possibilities provided by space technology;

(j) It is essential for developing countries to have access to information, preferably through regional centres, on what space technology is available, where and for what purposes;

(k) Regional cooperation is the most effective. A developing country will probably find more understanding of its problems from a partner within its region, and particularly from a country which has faced similar problems;

(l) Despite significant efforts in this field, training and the provision of appropriate manpower for developing countries remain a prerequisite. It must be recognized, too, that the introduction of space techniques will almost certainly entail re-training and re-deployment of existing personnel;

(m) Trained manpower and equipment will not, however, survive unless there is adequate in-country infrastructure and a commitment to use this capability where it can help;

(n) More coordination and distribution of information is required, and the existing structure does not seem adequate. For example, OOSA, regional centres etc. Reinforcement in manpower and information dissemination capacity (as recommended by UNISPACE 82) is needed, particularly on a regional basis.

B. Earth observation

36. With regard to Earth observation, the participants agreed on the following points:

(a) A mechanism is needed to bring to the attention of space agencies the specific needs of developing countries. Can this be undertaken by OOSA?;

(b) When specifying new spacecraft and ground systems, space agencies should give more consideration to the needs of developing countries, and should cooperate with aid organizations and others to identify funding to cover any additional costs which may not be compatible with the space agency's own mandate;

(c) The production of cheap, ready-to-use, Earth observation software systems should be encouraged. Products should be checked by a reputable body (perhaps OOSA). These would be useful to get more developing countries started and to enable them to demonstrate rapid results;

(d) The Committee on Earth Observation Satellites (CEOS) should expedite its actions leading to the establishment of a common format for the exchange of satellite imagery, including system-corrected, geo-coded and classified imagery. This format should be amenable for use with the most common data media, as well as for direct digital transfer;

(e) CEOS should include more specialists from developing countries in its working groups – (even) from non-member States and organizations. (The same applies to other non-governmental organizations in this field, for example, the International Astronautical Federation.);

(f) CEOS should focus on the problem of ensuring the continuity of Earth observation data archives and advising on the use of new storage techniques by operators. This is not a commercially attractive activity, but the preservation of long-term data sets is essential;

(g) Budgetary pressures will continue to cause many developed countries to transfer Earth observation activities to the private sector. This will tend to inhibit "free" access to data and technology. There is presently no international mechanism to resolve this conflict, and existing discrepancies could therefore increase;

(h) Consideration should be given to establishing a programme to provide software for remote sensing and GIS to developing countries. The software, perhaps evaluated by an independent panel, should be capable of being run on standard PC hardware platforms. Such a programme could be funded through the United Nations by contributions from interested Member States;

(i) Although some progress has been made, more effort needs to be devoted to clarifying the legal status of satellite data when offered in evidence in the courts;

(j) The United Nations initiative to establish regional centres is to be commended, but it should be made clear that it by no means reduces the continued need for assistance from the developed countries, of which the International Institute for Aerospace Survey and Earth Sciences in the Netherlands is a particularly positive example.

C. Satellite telecommunications

37. The participants agreed on the following:

(a) The link between the development of a country's telecommunications capability and the growth of gross national product is generally accepted. The latest techniques will permit developing countries to avoid the heavy investment required for conventional wired telecommunications and can rapidly produce improvements;

(b) Wireless telecommunications, including mobile satellite systems, can be a cost-effective way of connecting remote locations to the outside telecommunications network;

(c) In principle, developing countries should first upgrade international telecommunications, then trunk connections and then local systems. However, the priorities need to be set by individual countries and few will wish to progress at the expense of rural communications which often need much improvement;

(d) There will be an inevitable tendency for most efforts to be directed towards the upgrading of urban telecommunications systems. Governments must recognize the need to seek a corresponding improvement in rural areas (which will not happen automatically) to stem the population flow to urban areas;

(e) India and China have demonstrated the power of satellite systems, supported by a simple and inexpensive ground segment, to bring education to rural areas. (The techniques used in such programmes also facilitate the distribution of TV programmes of doubtful educational value, but this is an in-country problem.);

(f) There is no longer any room for satellites which make inefficient use of the scarce orbital and frequency spectrum allocations. The ability of developing countries to benefit in an appropriate manner from these scarce resources will depend on efforts to ensure a more efficient management of the resources.

D. Space education

38. The subject of space education clearly merits a separate Workshop, and it was not possible in the limited time to do it justice. However, participants agreed that the advancement of space education, i.e. education on the utilization of space techniques in combination with other new techniques, is a critical element of sustainable development programmes.

39. The Workshop demonstrated that there is a need to systematize the knowledge, experience and expertise that have been painstakingly acquired in this field, and for this to be made widely available both to

developing and developed countries. If this is not carried out, much time and money will be spent redoing something that has already been done.

40. Of primary importance, here as elsewhere, is the importance of making use of the capabilities which directly exist in developing countries, and encouraging regional pooling of experience and resources.

41. Emphasis was also placed on the creation of institutes capable of sustaining their activity, as distinct from the training of individuals, who may have difficulty in applying their newly acquired expertise. It was noted that space education is needed even at the highest decision-making levels, in order to ensure an understanding of the potential of space technology to assist in solving the problems which are the main preoccupation of ministers and senior civil servants.

Notes

[1] Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992 (United Nations publication, Sales No. E.93.I.8 and corrigenda), vol. I: Resolutions Adopted by the Conference, resolution 1, annex II.

Annex

PROGRAMME OF THE WORKSHOP

DATE/TIME	SUBJECT	SPEAKER
12 SEPTEMBER 1994		
08.30-09.00	Arrival and registration	
	Opening session, keynote and theme address	
	Chairman: P. Hohenfellner (BMfAA)	
09.00-09.40	Opening ceremony:	
	Opening statements	W. Riedler (TUG) N. Jasentuliyana (UN) J. Ortner (ASA)
	Welcoming statements	H.E. A. Stingl (Mayor of Graz) H.E. P. Schachner-Blazizek (Deputy Governor of Styria)
09.40-10.10	Keynote address: "World space cooperation at the crossroads"	J. Mennicken (DARA)
10.10-10.40	Theme address: "Space policies for developing and newly industrialized countries"	U. R. Rao (India)
10.40-10.50	Break	
	The developing world and space policies	
	Chairman: R. Kneucker (BMWF)	
10.50-11.20	Benefits of space technology for the developing world	J. Arets (ESA)
11.20-11.50	The role of the developing world in space cooperation	S. Mehmud (Pakistan)
11.50-12.20	The role of the developed world in space cooperation	R. Barnes (USA)
12.20-12.50	Discussion	

Chairman: W. Riedler (TUG)

14.30-15.00	Trends in Earth observation data and pricing policies	A. Silvestrini R. Mroczynski (EOSAT)
15.00-15.30	Cost effectiveness of satellite Earth observation data in the developing world	G. Erachet (SPOT)
15.30-16.00	International cooperation in assuring the continuity of environmental satellite data	I. Revah (France)
16.00-16.15	Break	
16.15-17.15	Discussion	

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Remote sensing for the developing world

Chairman: U. R. Rao (ISRO)

09.00-09.30	Remote sensing for sustainable development	M. Chandrasekhar (India)
09.30-10.00	Earth observation data from space - cost, continuity and compatibility	W. Jensen (ESA)
10.00-10.15	Break	
10.15-10.45	Commercial enterprises and the production of value added remote sensing products	L. Beckel (Austria)
10.45-11.15	Remote sensing and natural resource management	A. Gagliardini (Argentina)
11.15-12.30	Discussion	
12.30-14.00	Lunch	

Technical presentations

Chairman: J. Arets (ESA)

14.00-14.30	Mapping the African rainforests	D. Mabi (Cameroon)
14.30-15.00	Application of GIS and remote sensing for integrated land-resource and land-management studies	G. Camara (Brazil)

15.00-15.30	Earth observation data and environmental protection	R. Witt (UNEP)
15.30-16.15	Discussion	
16.15-16.30	Break	
16.30-17.30	General discussion and preparation of draft recommendations	

14 SEPTEMBER 1994

Space communications and developing countries

Chairman: R. Barnes (USA)

09.00-09.30	Satellite communications: Challenges and opportunities for the developing world	P. Swan (USA)
09.30-10.00	Satellite communications for development	V. Gullá (Telespazio)
10.00-10.15	Break	
10.15-10.45	Modernization through satellite and mobile communications	D. Wright (INMARSAT)
10.45-11.15	Mass education through space technology	F. Gao (China)
11.15-12.30	Discussion	

Technical presentations

Chairman: S. Mehmud (Pakistan)

14.00-14.30	Communication services in the Commonwealth of Independent States	Y. Zubarev (Russia) V. Kotelnikov (UN)
14.30-15.00	Emerging space communications infrastructures	R. Rusin (Poland)
15.00-15.30	Communication satellite activities in the Asia-Pacific Region	S. Chung (Republic of Korea)
15.30-16.15	Discussion	
16.15-16.30	Break	
16.30-18.00	General discussion and preparation of draft recommendations	

15 SEPTEMBER 1994

Space education

Chairman: P. Jankowitsch (BMfAA)

09.00-09.20	Science and technology education: The experience in cooperating with developing countries	N. Mulder (ITC)
09.20-09.40	Space education and training in the developing countries	S. Camacho (UN)
09.40-10.00	Space education for understanding global needs	L. Stojek (ISU)
10.00-10.20	Discussion	
10.20-10.30	Break	

Report preparations

10.30-13.30	(i) Drafting group: Remote sensing (ii) Drafting group: Space communications

Presentation and discussion of recommendations

Chairman: R. Gibson (UK)

15.00-15.30	Presentation of recommendations and observations by the working groups
15.30-16.30	General discussion

Closing ceremony

16.30-17.00	Adoption of report and closing ceremony